Fluid Dispensing Device

FIELD OF THE INVENTION

The present invention relates generally to fluid dispensing devices and, more specifically, to cleaning chemical dispensers for flush toilets.

BACKGROUND OF THE INVENTION

Many devices have been proposed and manufactured for automatic dispensing of cleaning chemicals into flush toilets. Typical examples from recent prior art are U.S. Patent Number 5,252,957 to Campau, U.S. Patent Number 5,488,742 to Liao, and U.S. Patent Number 6,151,722 to Lubrano. While the inventions therein disclosed apparently meet their stated objectives, none of the examples of the prior art have the combined advantages of simplicity and ease of manufacture, easy installation, and dosage control with resulting economy in chemical usage.

SUMMARY OF THE INVENTION

The present invention seeks to provide a chemical dispenser for a flush toilet that is simple and inexpensive to manufacture, easy to install in existing toilets, and that provides a controlled dosage of chemical each time the toilet is flushed.

There is thus provided, in accordance with a preferred embodiment of the invention, a chemical dispenser for use with a flush toilet including:

a chemical storage chamber for a chemical which is to be added to the flushing water of the toilet;

mounting apparatus fabricated to allow the chemical dispenser to be readily mountable on an existing opening in the water storage tank of the toilet; and

a dispensing mechanism operative to dispense a predetermined quantity of the chemical into the flushing water of the toilet each time the toilet is flushed.

Further in accordance with a preferred embodiment of the invention, the dispensing mechanism includes a float located in the water storage tank of the toilet operative to drive the

dispensing mechanism as it rises and falls with the water level in the water storage tank of the toilet.

In accordance with a further preferred embodiment of the invention, the dispensing mechanism is driven by the pressure of water flowing into the water storage tank of the toilet.

In accordance with an additional preferred embodiment of the invention, the dispensing mechanism includes apparatus for producing an increase in pressure within the dispensing mechanism in response to the refilling of the water storage tank of the toilet after flushing, and for dispensing a predetermined quantity of the chemical into the flushing water of the toilet each time the toilet is flushed.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more fully understood and appreciated from the following detailed description, taken in conjunction with the drawings, in which:

Fig. 1 is a representation of a chemical dispenser for a flush toilet, constructed and operative in accordance with a preferred embodiment of the present invention;

Figs. 2A and 2B are representations, in two operative states: a filling state and a dispensing state, respectively; of a dispensing mechanism of a chemical dispenser for a flush toilet, constructed and operative in accordance with an alternative preferred embodiment of the present invention;

Fig. 3 is a representation of a chemical dispenser for a flush toilet constructed and operative in accordance with a further embodiment of the present invention;

Fig. 4 is a representation of a chemical dispenser for a flush toilet constructed and operative in accordance with a further preferred embodiment of the present invention; and

Fig. 5 is shown a representation of a chemical dispenser for a flush toilet constructed and operative in accordance with an additional preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to Fig. 1, there is shown a representation of a chemical dispenser for a flush toilet, referred to generally as 100, constructed and operative in accordance with a preferred embodiment of the present invention. Chemical dispenser 100 includes chemical

storage chamber 101, which has a removable stopper 103 to allow chamber 101 to be filled with the chemical to be dispensed. Chemical storage chamber 101 is mounted on toilet tank 120 via supply tube 109, connecting sleeve 104, and mounting ring 106. Threaded ring 107 advantageously provides pressure on mounting ring 106 against connecting sleeve 104 and gasket 105 to fix chemical dispenser 100 in place with a fluid-tight seal. Note the angle of supply tube 109, which allows the chemical in storage chamber 101 to flow into the device due to gravity. It should be further noted that since most toilet tanks are produced with two holes to provide alternative positioning of the water input valve, chemical dispenser 100 can be readily installed on most toilet tanks without the need to drill a new hole therein.

Supply tube 109 feeds dispensing mechanism, referred to generally as 150, via entry hole 123. Dispensing mechanism 150, in the present embodiment, is located within toilet tank 120. When toilet tank 120 is full, as shown in the drawing, float 118 and attached rod 115 drive valve seat 114 upward in cylinder 127 so that entry hole 123 is uncovered, allowing the chemical to flow from storage chamber 101 via supply tube 109 and entry hole 123 into cylinder 127, filling it and upper chamber 129. Venting valve 111 releases the air pressure in upper chamber 129 so that it can fill with the chemical until float portion 131 of venting valve 111 rises to seal with upper stopper 110 of cylinder 127, which further serves to prevent leakage of the chemical via venting valve 111. Ring 112 on the upper portion of venting valve 111 prevents the valve from falling into upper chamber 127, without sealing the venting air flow. This arrangement ensures that a predetermined amount or dosage of the chemical will be held in cylinder 127 and upper chamber 129 for dispensing into the water in toilet tank 120.

When the toilet is flushed, the water level in toilet tank 120 is below dispensing mechanism 150, so that float 118 and attached rod 115 are driven downward by gravity and by spring 113. Valve seat 114 is also lowered by gravity and by spring 113, covering entry hole 123 and uncovering exit hole 125 to release the chemical into toilet tank 120. As toilet tank 120 refills, float 118 and attached rod 115 will again rise, driving valve seat 114 upward to seal exit hole 125 and to uncover entry hole 123 as described above, thereby preparing another measured dose of the chemical for release the next time the toilet is flushed.

Referring now to Figs. 2A and 2B, there are shown representations in two operative states: a filling state and a dispensing state, respectively, of a dispensing mechanism 250 of a chemical dispenser for a flush toilet, constructed and operative in accordance with an alternative preferred embodiment of the present invention. In the present embodiment, dispensing mechanism 250 takes the place of dispensing mechanism 150 of the embodiment shown in Fig. 1, with a similar chemical storage chamber, mounting, and supply tube 209.

When the toilet tank is empty, dispensing mechanism 250 is in its filling state as shown in Fig. 2A. Float 218 lowers, as shown in Fig. 2A, together with attached rod 215 and upper and lower portions of piston 231, 214, respectively; which are further forced downward by lower spring 216 so that lower portion 214 of the piston uncovers entry hole 223 thereby allowing the chemical to enter the central chamber of dispensing mechanism 250 via supply tube 209 due to the force of gravity. Upper spring 213 maintains a constant spacing between upper 231 and lower 214 portions of the piston, thereby fixing the volume available in dispensing mechanism 250 for holding the chemical and hence, the dosage thereof. At the same time, upper portion 231 of the piston covers exit hole 225, thereby preventing the chemical from leaving dispensing mechanism 250 and ensuring a constant dosage of the chemical will be ready for dispensing.

When the toilet tank fills, dispensing mechanism 250 is driven by float 218 into its dispensing state, as shown in Fig. 2B. Float 218 and attached rod 215 drive the piston upward so that its lower portion 214 covers entry hole 223, preventing further entry of the chemical into the chamber, and so that its upper portion uncovers exit hole 225, releasing the measured dose of the chemical into the toilet tank thereby.

Referring now to Fig. 3, there is shown a representation of a chemical dispenser for a flush toilet, referred to generally as 300, constructed and operative in accordance with a further embodiment of the present invention. Chemical dispenser 300 includes chemical storage chamber 301, which has a removable stopper 303 to allow chamber 301 to be filled with the chemical to be dispensed. Chemical dispenser 300 is connected directly to dispensing mechanism, referred to generally as 350, by which it is mounted on toilet tank 320, via an existing hole therein, similar to the mounting of chemical dispenser 100 explained above in relationship to Fig. 1.

When toilet tank 320 is full, float 318 rises, driving attached rod 315 upwards through dispensing mechanism 350. Rod 315 has a sloped indentation or slot 331 in which rides eccentric protrusion 335 of valve seat 314. When rod 315 is in its uppermost position, as shown in Fig. 3, eccentric protrusion 335 of valve seat 314 is driven all the way into sloped slot 331 by spring 313 to its leftmost position as shown in the drawing. In that position, the other end 337 (rightmost in the drawing) of valve seat 314, which is slotted, thinned, or tapered, is positioned in the end cap 316 of dispensing mechanism 350, thereby allowing the chemical in storage chamber 301 to flow, driven by gravity, into cylinder 327 of dispensing mechanism 350 via the slots in end portion 337, thus filling it. At the same time, wide end 339 of valve seat 314 (leftmost in the drawing) will sit in the end of cylinder 327, thus preventing exit of the chemical. Cylinder 327 preferably has a venting tube 341 aligned with slot 345 in wide end 339 of valve seat 314 to allow cylinder 327 to fill without resistance due to air pressure. Dosage of the chemical is determined by the internal volume of cylinder 327.

When the toilet is flushed, the water level in toilet tank 320 drops, as will float 318 with rod 315, which are further driven downward by spring 311. Eccentric protrusion 335 of valve seat 314 is driven by sloped slot 331 to its rightmost position as shown in the drawing, simultaneously sealing end cap 316 of dispensing mechanism 350 with the cylindrical portion of valve seat 314, thereby preventing further flow of the chemical into cylinder; and offsetting wide end 339 of valve seat 314 from the end of cylinder 327, thereby allowing the chemical to exit dispensing mechanism 350 for toilet tank 320 via slot 345 in valve seat 314 and exit hole 325.

Referring now to Fig. 4, there is shown a representation of a chemical dispenser for a flush toilet, referred to generally as 400, constructed and operative in accordance with a further preferred embodiment of the present invention. Chemical dispenser 400 is contained within chemical storage chamber 401 and is typically mounted on toilet tank 420 on an existing hole therein, as explained above with respect to the embodiment shown in Fig. 1.

When the toilet is flushed and water starts flowing into toilet tank 420 to refill it, the water passes, driven by the local water pressure, through chemical dispenser 400 via water inlet tube 421 from the toilet tank fill valve (not shown) which is attached to inlet sleeve 422 of chemical dispenser 400. The fluid flows through lower conduit 425 into the dispensing

mechanism, referred to generally as 450, and impels driving sleeve 435 to the left, as shown in the drawing, until it catches valve seal cylinder 414 by shoulder ring 437 and drives it to the end of mixing chamber 429. When valve seal cylinder 414 reaches the end of mixing chamber 429, entry holes 423 from chemical storage chamber 401 are uncovered, allowing the chemical to enter mixing chamber 429 and mix with the flowing water that flows through slots 424 in valve seal cylinder 414 before it passes into toilet tank 420 via exit hole 425. The flow rate of the chemical into mixing chamber 429 and, hence, the amount of chemical added to the water flow is preferably controlled by chemical flow control screw 445 as well as by the rate of water flow through dispensing mechanism 450.

As toilet tank 420 fills, the water flow slows and spring 413 pushes driving sleeve 435, which is no longer compelled by the pressure of the water flow, back to the right until it catches end ring 439 of valve seal cylinder 414 and drives it until it covers entry holes 423 from chemical storage chamber 401, thereby cutting off further entry of the chemical into dispensing mechanism 450 until the next time the toilet is flushed.

Referring now to Fig. 5, there is shown a representation of a chemical dispenser for a flush toilet, referred to generally as 500, constructed and operative in accordance with an additional preferred embodiment of the present invention. Chemical dispenser 500 is contained within chemical storage chamber 501 and is typically mounted on toilet tank 520 on an existing hole therein, as explained above with respect to the embodiment shown in Fig. 1. Chemical storage chamber 501 is connected to dispensing cup 529 via vertical chemical transfer tube 535. Dispensing cup 529 is connected to toilet tank 520 via chemical exit tube 525 and air tube 545.

In the present preferred embodiment, chemical storage chamber 501 is airtight, including stopper 503. As a result, when chemical dispensing cup 529 contains a measured dose of the chemical, as shown in the drawing, and the bottom end of vertical chemical transfer tube 535 is immersed in the chemical, no additional chemical will flow from chemical storage chamber 501 via chemical transfer tube 535 into dispensing cup 529. Any time after the toilet has been flushed, the water level in toilet tank 520 is below the end of air tube 545 extending therein, and there is no air pressure to drive the chemical from dispensing cup 529 into toilet tank 520 via chemical exit tube 525. As toilet tank 520 fills, the water level therein

reaches the end of air tube 545 and continues to rise until toilet tank 520 is full. The water level in air tube 545 also rises, thereby compressing the air therein and in the upper portion of dispensing cup 529. The increased air pressure in dispensing cup 529 drives the measured dose of chemical in the lower portion thereof out into toilet tank 520 via chemical exit tube 525.

With dispensing cup 529 emptied, the lower end of chemical transfer tube 535 is no longer immersed, and it is possible for air bubbles to rise via chemical transfer tube 535 and reach chemical storage chamber 501. As a result, some of the chemical flows down chemical transfer tube 535 into dispensing cup 529 until the bottom end of vertical chemical transfer tube 535 is immersed in the chemical, thereby cutting off further flow of the chemical, as described above, and ensuring that a predetermined amount or dosage of the chemical will be stored in dispensing cup 529. It should be noted that as the measured dose of chemical, which is determined by the volume of air in air tube 545 and the air pressure developed therein, as described above, flows out of dispensing cup 529, chemical exit tube 525 will allow air pressure equalization in dispensing cup 529, even though the end of air tube 545 in toilet tank 520 is immersed in water, so there will be no buildup of air pressure in dispensing cup 529. Thus chemical dispenser 500 is in a stable state, with dispensing cup 529 containing the full measured dose of chemical, and toilet tank 520 is filled with water, until the next time the toilet is flushed.

It will further be appreciated by persons skilled in the art that the scope of the present invention is not limited by what has been specifically shown and described hereinabove, merely by way of example. Rather, the scope of the present invention is defined solely by the claims, which follow.